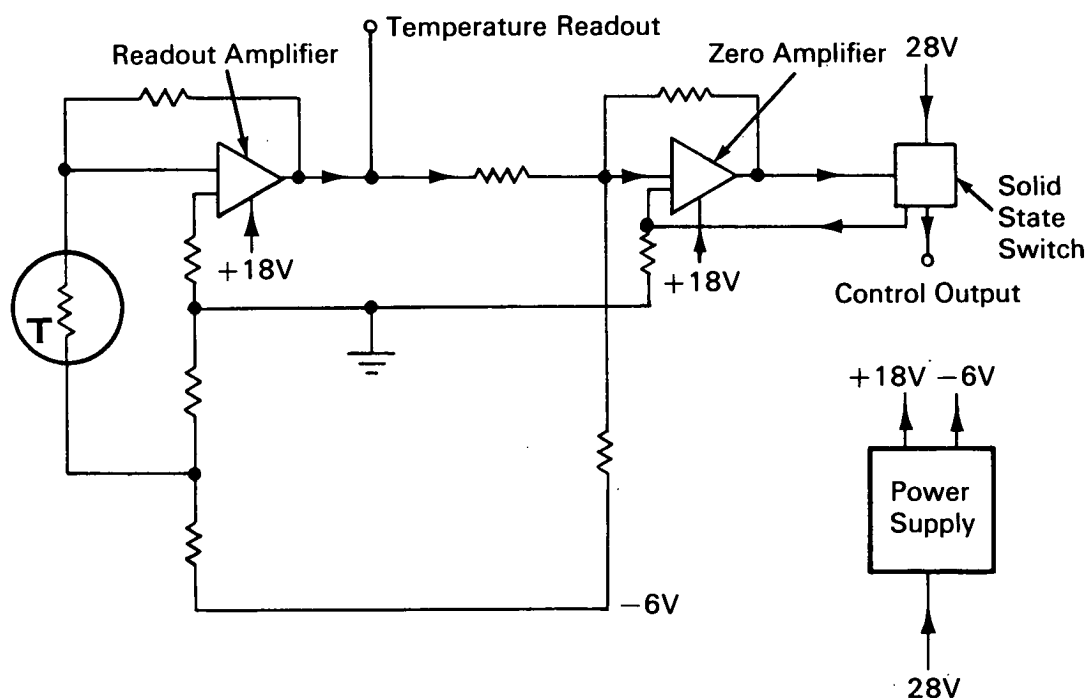


# NASA TECH BRIEF



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## Solid State Thermostat Has Integral Probe and Circuitry



### The problem:

To develop a rugged, reliable thermostat without moving parts that will provide a temperature readout signal and a continuous temperature-control output for monitoring the temperature by automatic check-out equipment or telemetry systems. The readout signal must lie in the range from 0.5 volt ( $0^{\circ}\text{C}$ ) to 5 volts ( $50^{\circ}\text{C}$ ), and temperature control must be maintained within  $\pm 0.2^{\circ}\text{C}$  in the range from  $25^{\circ}$  to  $50^{\circ}\text{C}$ .

### The solution:

A compact thermostat employing a thermistor probe and a solid state circuit mounted in a housing rigidly attached to the probe.

### How it's done:

The thermostat consists of five functional units: a thermistor temperature-sensing element, a readout amplifier, a zero amplifier, a solid state switch, and a power supply. The circuit uses 13 transistors and 6 semiconductor diodes. The probe, which houses and protects the thermistor, is hermetically sealed and employs a copper tip to ensure good heat transfer to the thermistor. The thermistor, which is connected to a source of constant voltage, has a high impedance to minimize self-heating and consequent error signals. This thermistor forms the temperature-varying input resistance to the readout amplifier. The output voltage

(continued overleaf)

from this amplifier, which is dependent on the temperature sensed by the thermistor, is used as the temperature readout signal and as the input signal to a preselected resistor network where the signal is compared to a reference voltage derived from the power supply. Any deviation of the readout voltage from a preset reference voltage is detected and amplified by the zero amplifier. The output of this amplifier is applied to the solid state switch connecting the heating load to the 28-volt line.

The power supply, which operates from a 28-volt source, provides two regulated voltages, 18 volts and -6 volts. The 18-volt line supplies the amplifiers, and the -6 volt line serves as a reference for both the readout amplifier and the zero amplifier.

**Note:**

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama, 35812  
Reference: B66-10193

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D. C., 20546.

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